

A NEW SPECIES OF *PARAMELITA* (CRUSTACEA: AMPHIPODA)
FROM SOUTH AFRICA

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(With 3 figures)

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INTRODUCTION

In his major contribution to the amphipod fauna of South Africa, Barnard (1916) assigned to the genus *Gammarus* four new species from fresh-water localities in the Cape Peninsula. These records were the first of fresh-water amphipods from South Africa, and with the exception of *Gammarus pulex* (L.) as noted by Krauss (see Stebbing 1910: 456), the first record of the genus from South Africa. Schellenberg (1926) erected the genus *Paramelita* for the new species *P. ctenodactyla* described from material collected by the Deutsche Süd-polar-Expedition. In the following year, Barnard published results obtained from collections made in fresh-water localities in the south-western part of the Cape Province (Barnard 1927). Although Barnard was able to equate *P. cteno-dactyla* with *Gammarus capensis* Barnard, 1916, he found it necessary to erect a further six species, thus raising to ten the number of *Gammarus* known from fresh-water localities in South Africa. Schellenberg (1937) showed that the South African species assigned to *Gammarus* were sufficiently distinct from those of Palaearctic and Nearctic Regions to warrant generic separation, and so transferred them to *Paramelita*.

In 1970 I received from Miss Mary Hazleton, Honorary Biological Recorder of the Cave Research Group of Great Britain, a small collection of amphipods which, among the European material, contained two specimens from South Africa. This material clearly belonged to the genus *Paramelita*. A comparison with syntype material of most of the species described by Barnard, which had been deposited at the British Museum (Natural History) in 1928, precluded the present specimens from any of these species. The two specimens are therefore described herein as a new species, *Paramelita barnardi* sp. nov.

The species is dedicated to the late K. H. Barnard in recognition of his significant contributions to the knowledge of the fauna of South Africa and of tropical and Southern Hemisphere amphipods.

MATERIAL

The holotype, a 9 mm male, has been deposited in the collection of the British Museum (Natural History) under the registration number 1972:542:1, and the allotype, a 9 mm female, is registered in the collection of the South African Museum under number S.A.M. A13199.

Both specimens were collected from Boomslang Cave, Cave Peak, above Kalk Bay, near Cape Town, South Africa. They were found by M. Ware in a small muddy pool in the dark zone on 23 June 1969.

DESCRIPTION

The description is based on the holotype, which differs from the allotype only in minor details of setation and spination. Body moderately compressed, peraeon five fourths length of pleon. *Peraeon*, coxae 1 to 4, depth a little less than corresponding segments, segments 2 to 7 bearing branchiae, those of segment 7 the smallest. Accessory branchiae present on peraeon segments 2 to 7; one on segments 2 and 3, two on segments 4, 5 and 7 and four on segment 6. *Pleon* segments with setae dorsally, segments 1-3 each with 6-7 setae at posterior margin, segments 4 and 5 with 2-4 setae on posterior margin and paired groups of 5-6 setae a little anterior and lateral to the mid-point of the posterior margin; segment 6 similar to 4 and 5 but with a spine and 3 setae in each lateral group. *Epimeron* 1, distally rounded, posterior margin convex and armed with ca 12 short, fine setae set in minute notches; two ranks of ten and six setae exteriorly just above distal margin. *Epimeron* 2, deeper than epimeron 1, distally rounded; posterior margin barely convex, armed with fine setae; five ranks of 7, 13, 15, 6 and 13 setae above distal margin; a spine among the setae of the third rank. *Epimeron* 3, similar to second but a little broader; setae on posterior margin less regularly spaced; six ranks of 7, 8, 12, 2, 10 and 9 setae above distal margin; first two ranks also contain single spines.

Head longer than first peraeon segment; rostrum obsolete, eye lobe deep, but not sharply produced, broadly rounded above, obtusely angled below; post-antennal angle sub-acute with 3-4 short setae anteriorly; margin between eye lobe and post-antennal angle excavate to accommodate inflated basal article of antenna 2; epistome straight, not protruding beyond upper lip; eye small, unpigmented in alcohol, apparently degenerate and lacking ommatidia. *Antenna* 1, length equal to that of head and peraeon segments 1 to 6 combined; lengths of peduncle articles in ratio 3:2:1; flagellum of 35 articles, just more than twice length of peduncle, each article with several short, fine setae, disto-ventrally; accessory flagellum of 5 articles, just shorter than article 2 of peduncle. *Antenna* 2, $\frac{5}{6}$ length of antenna 1; article 1 of peduncle inflated,

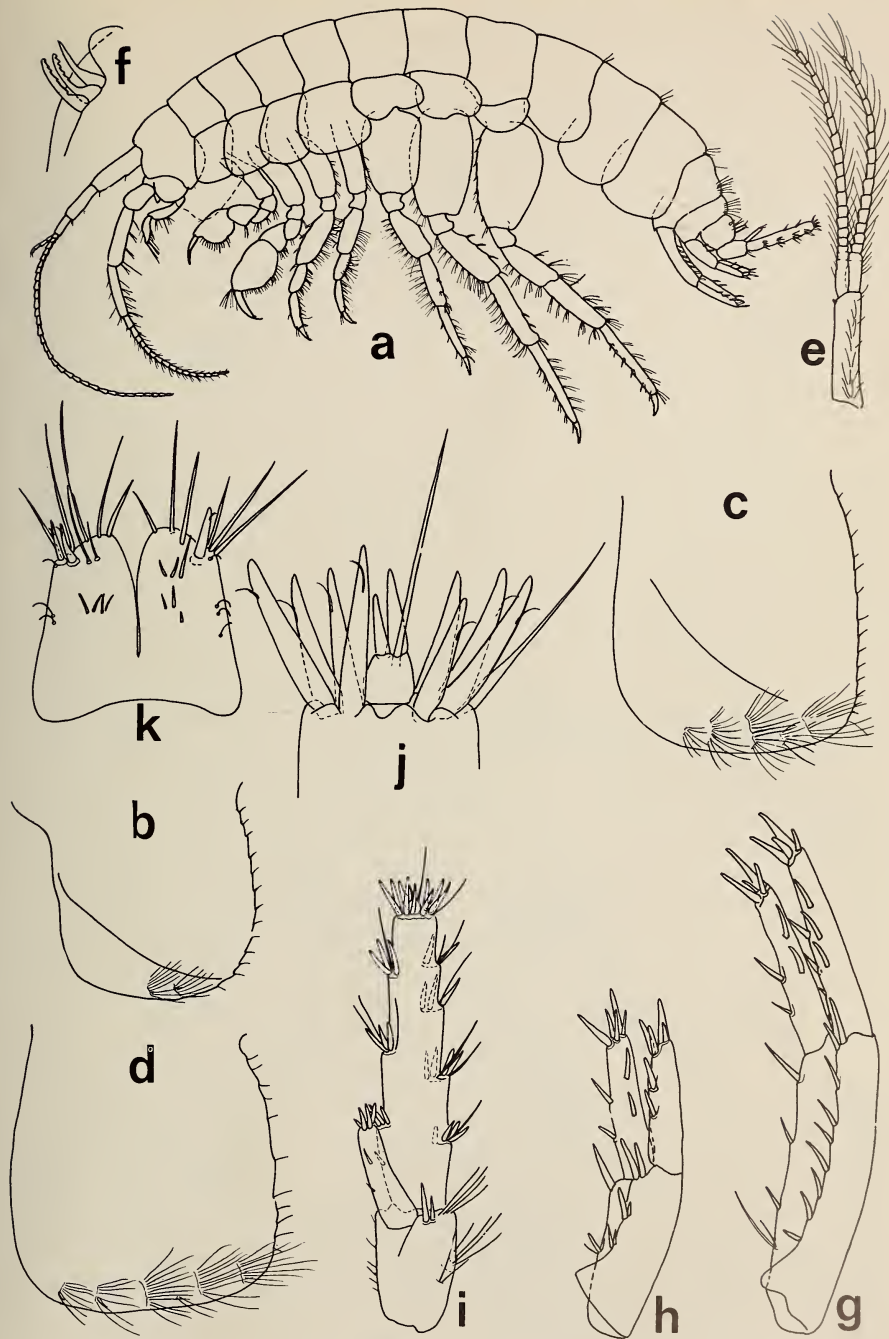


Fig. 1. *Paramelita barnardi* sp. nov.

a. Habitus. b. Epimeron 1. c. Epimeron 2. d. Epimeron 3. e. Pleopod 1. f. Locking spines of pleopod 1. g. Uropod 1. h. Uropod 2. i. Uropod 3. j. Second article of outer ramus of uropod 3.

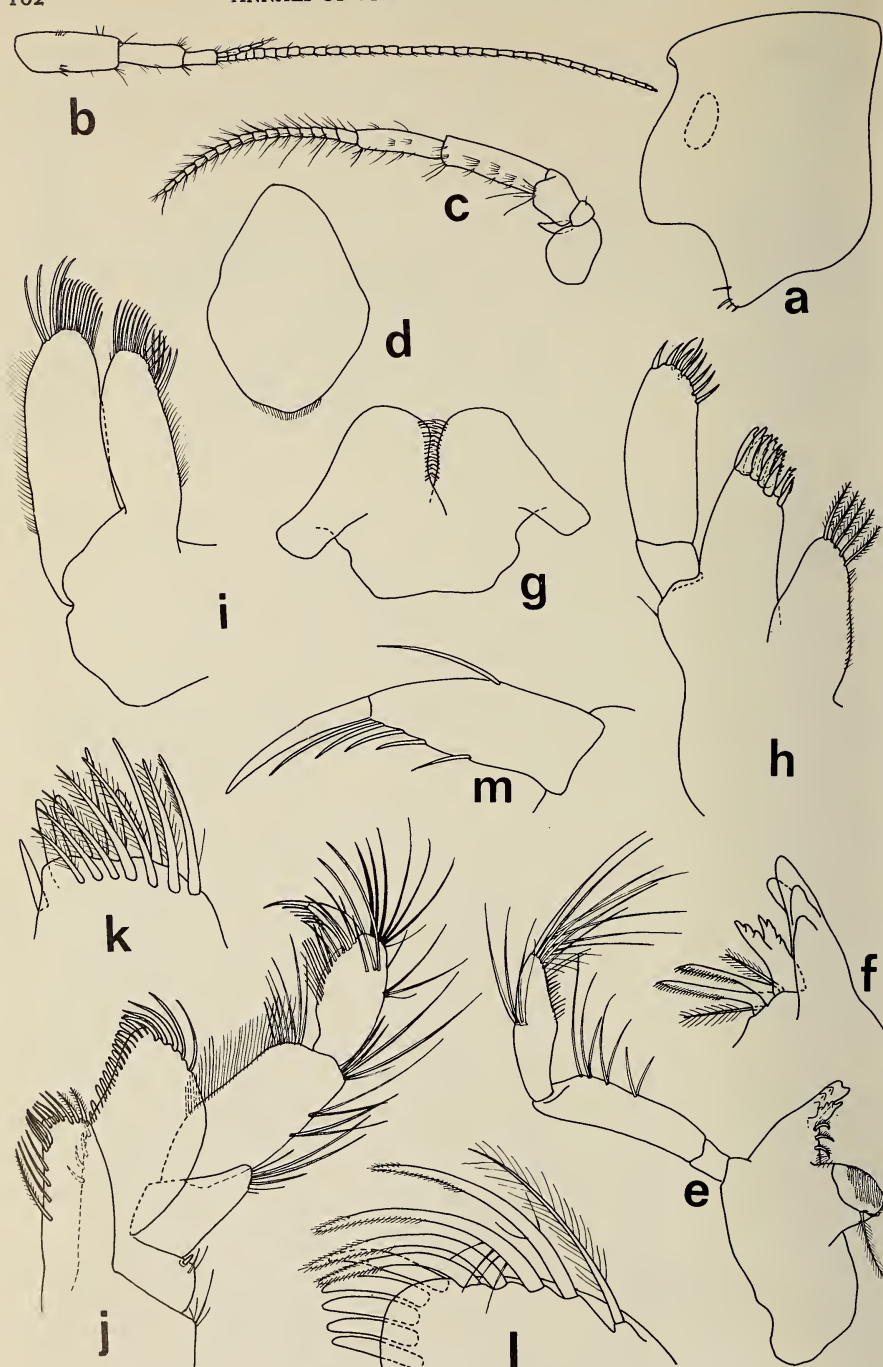


Fig. 2. *Paramelita barnardi* sp. nov.

a. Head, b. Antenna 1. c. Antenna 2. d. Upper lip. e. Left mandible. f. Apex of right mandible. g. Lower lip. h. Maxilla 1. i. Maxilla 2. j. Maxilliped. k. Inner plate of maxilliped. l. Outer plate of maxilliped. m. Dactyl of palp of maxilliped.

broadly ovoid, article 4 stouter than and $\frac{1}{5}$ longer than fifth article; flagellum $\frac{2}{3}$ to $\frac{3}{4}$ length of peduncle, of 17 articles, each article bearing groups of graded setae anteriorly and posteriorly close to the distal margin. *Upper lip* rounded, distally setose. *Left mandible*, incisor process bluntly five-toothed; lacina mobilis with four blunt teeth; spine row consisting of three hooked spines, each strongly and bilaterally pectinate; molar cylindrical, triturating surface oblique, armed with ridges and teeth and with a long plumose seta proximally at the edge of the triturating surface; palp rather longer than body of mandible; first article just longer than wide; second much longer than first, with seven setae on distal half of slight anterior expansion; third article narrowly pyriform, $\frac{5}{8}$ length of second article, anterior half of margin naked, distally armed with row of short, sharp setae, and terminal $\frac{1}{4}$ bearing *ca* 14 long, stout setae in two parallel rows. *Right mandible*, differs from left in having the incisor process with four blunt teeth, lacina mobilis bifurcate, each branch bearing four sharp teeth and spine row of two straight, stout, unilaterally pectinate spines and two plumose setae. *Maxilla 1*, inner plate triangular, apex subacute and bearing five plumose setae, inner margin pubescent; outer plate with 10 to 11 stout, toothed spines distally; palp, moderately broad, second article with broadly rounded apex armed with eight spines and two subapical setae on posterior margin. *Maxilla 2*, inner plate a little shorter and narrower than outer, apex broadly rounded, two ranks of setae, one apical and the other subapical, just extend on to inner margin, inner margin proximally pubescent; outer plate with broadly rounded apex bearing row of *ca* 15 setae, the posterior surface bears a submarginal row of 11 long stout setae just below the apex. *Lower lip*, inner lobes absent, outer lobes strongly setose on inner margin, mandibular process well developed. *Maxilliped*, inner plate apically truncate, armed with three stout and two slender spines at the apex and a subapical row of seven plumose setae which is contiguous with the row of ten plumose setae on inner margin; outer plate longer than inner, extending to $\frac{3}{8}$ length of palp article 2, rounded apex with five long curved pectinate spines, inner margin with *ca* 16 stout, blunt and closely set spine teeth; palp article 2 the longest, second and third articles densely setose medially; dactyl rather slender with five setae on medial margin, unguis forming nearly half of total length.

Gnathopod 1, coxa rectangular, distal margin setose; basal longer than depth of coxa, carpus and propod subequal, together as long as basal; propod distally expanded, length $\frac{3}{2}$ of breadth, palm gently convex, as long as posterior margin, armed with *ca* 25 setae of various lengths; palmar angle with 5 spines; dactyl as long as palm. *Gnathopod 2*, coxa slightly narrowed distally, rather longer than coxa 1, distally setose; carpus and propod combined a little longer than basal; propod nearly twice as long as carpus, otherwise similar to gnathopod 1. *Peraeopod 3*, coxa similar in form to that of gnathopod 2, but a little deeper, depth just greater than length: basal $\frac{4}{5}$ length of coxa; article 4 $\frac{5}{8}$ length of basal, equal to carpus and propod combined, length four times breadth, somewhat expanded, strongly setose posteriorly and with three groups of spines

and setae anteriorly; carpus more slender than merus, stouter and just shorter than propod, carpus and propod strongly armed with spines and setae posteriorly; dactyl half length of propod, somewhat hooked, with three spine setae posteriorly. *Peraeopod 4*, coxa rectangular, height and length subequal, shallowly excavate posteriorly, posterior angle obtuse, setose on posterior and posterior-ventral margins; distal articles similar to, but slightly shorter than those of peraeopod 3. *Peraeopod 5*, coxa, longer than deep, bilobed, anterior lobe the deeper, three short setae on posterior margin, basal expanded posteriorly, breadth $\frac{2}{3}$ of length, posterior distal lobe rounded, weak, anterior margin armed with spines and setae, posterior margin with *ca* 18 short fine setae; merus $\frac{3}{4}$ length of basal, rather stout, strongly setose anteriorly, a single stout spine on posterior margin; carpus and merus subequal, but former only half width of latter, armed with setae on anterior margin and spines posteriorly; propod subequal in length, but more slender than carpus, armed with spines anteriorly and setae posteriorly; dactyl apically hooked, with six spine setae anteriorly. *Peraeopod 6*, *ca* $\frac{4}{5}$ length of peraeopod 5, coxa weakly bilobed, three short setae on margin above posterior-distal angle; basal expanded, breadth $\frac{3}{4}$ of length, posterior distal lobe rounded, weak, anterior margin with spines and setae, posterior margin just concave, lined with 22 fine setae; merus $\frac{2}{3}$ length of basal, length three times breadth, strongly setose anteriorly, two stout spines posteriorly; carpus subequal in length to merus, but more slender, strongly armed anteriorly with spines and setae; propod a little shorter than basal, rather slender, breadth less than $\frac{1}{6}$ of length, strongly spinous anteriorly and with many setae posteriorly; dactyl $\frac{1}{3}$ length of propod, similar in form to that of peraeopod 5. *Peraeopod 7*, just shorter than peraeopod 6; coxa semicircular, setose on posterior $\frac{1}{3}$ of free margin; basal expanded, distinctly tapering distally, posterior-distal lobe obsolete, armed with spines and setae anteriorly and short setae posteriorly; merus rather stout but not strongly produced distally; carpus $\frac{4}{5}$ length of merus, breadth $\frac{2}{3}$ of length; propod $\frac{1}{6}$ longer, but more slender than carpus; merus, carpus and propod densely clothed with spines and setae anteriorly, less so posteriorly, dactyl $\frac{1}{3}$ length of propod, structure as in peraeopods 5 and 6.

Pleopods are fully developed, rather slender, length of peduncle four times breadth, setae of rami rather short. *Uropod 1*, rather stout, dorso-lateral margins of peduncle with nine spines, dorso-medial margin with three; rami subequal, $\frac{2}{3}$ length of peduncle, outer ramus with three spines on each margin, inner ramus with three on outer margin and two on inner, each ramus with two long and three shorter apical spines. *Uropod 2*, short, stout, extending posteriorly only as far as apices of uropod 1; peduncle with three pairs of spines on outer margin and two single spines on inner; inner ramus $\frac{5}{8}$ length of peduncle with two spines on each margin; outer ramus $\frac{3}{4}$ length of peduncle with two and one spines on outer and inner margins respectively; each ramus with five apical spines. *Uropod 3*, peduncle short, stout, breadth *ca* $\frac{3}{8}$ of length; inner ramus short, tapering distally, length $\frac{4}{5}$ of peduncle, lateral spines zero and two respec-

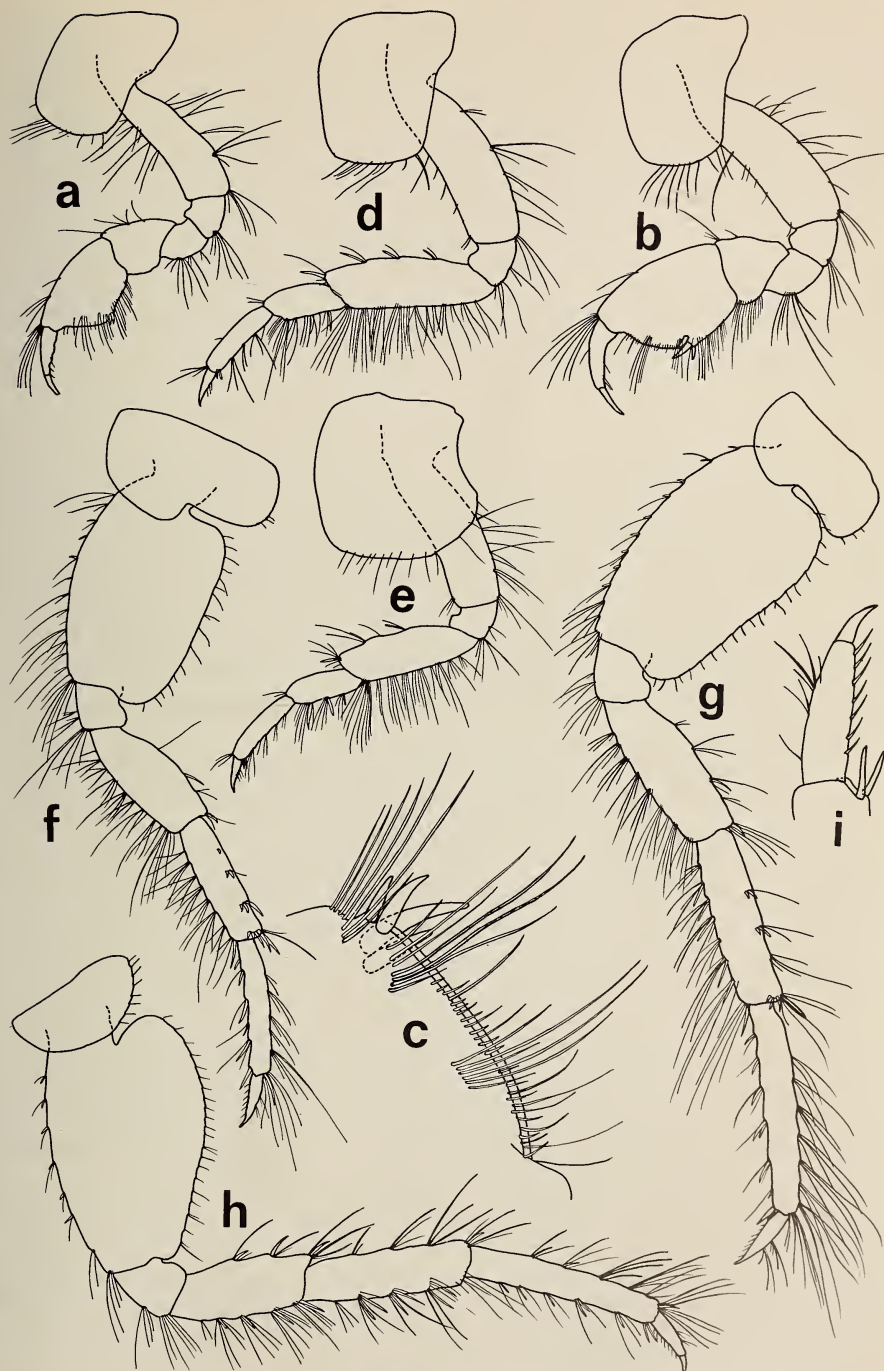


Fig. 3. *Paramelita barnardi* sp. nov.

a. Gnathopod 1. b. Gnathopod 2. c. Palm of gnathopod 2. d. Pereopod 3. e. Pereopod 4. f. Pereopod 5. g. Pereopod 6. h. Pereopod 7. i. Dactyl of pereopod 7.

tively, apically four spines and two setae; first article of outer ramus much longer than inner, length more than twice that of peduncle, breadth $\frac{1}{4}$ of length, laterally strongly armed with 4 + 4 groups of stout spines and some setae, apex truncate with corona of ten stout spines; second article very short, ca $\frac{1}{15}$ length of first article, apically with two spines and a seta, length of second article together with apical spines not exceeding that of apical spines of first article. *Telson*, rather broader than long, cleft $\frac{4}{5}$ length, lobes a little dehiscent distally; apices irregularly rounded, armed with one or two apical spines and four or five apical or subapical setae, dorsal surface with four to six short setae asymmetrically arranged and two or three short plumose setae close to the lateral margin of each lobe.

DISCUSSION

The genus *Paramelita* in South Africa consists of a closely related group of species some of which show curious morphological modifications involving the peduncle of antenna 2 and, in one case, pereopod 3. These variations are fully developed only in adult males, but are usually distinguishable in a weaker form in immature males. Differences between females of the various species are more subtle. Apart from antenna 2 and pereopod 3, some degree of sexual dimorphism is usually apparent in the gnathopods, although this is rarely as obvious as is the case in many European species belonging to *Gammarus* and allied genera.

Paramelita barnardi is characterized by the following attributes: medium size, unpigmented eyes, unmodified male antenna 2, oblique palmar margins and the relative size of propods of gnathopods 1 and 2, unmodified male pereopod 3, rectangular and weakly excavate coxa 4, strongly spinose and setose pereopods 5-7, and minute second article of uropod 3.

The weakly excavate coxa 4 of *P. barnardi* distinguishes this species from *P. capensis* and *P. nigroculus*. *P. capensis* also differs in having more broadly expanded basal articles of pereopods 5-7 and setose rather than spinose uropod 3. Additional characters separating *P. nigroculus* from *P. barnardi* are the pigmented eye, slender gnathopod 2 propod and acutely produced posterior-distal angle of epimeron 3 of the former. Epimera 3 of *P. nigroculus* var. *persetosus* more nearly resemble those of *P. barnardi* than the typical variety, but the marked difference in the degree of setal armature of antenna 2 affords an additional character by which the new species can be distinguished.

P. auricularis, *P. crassicornis*, *P. seticornis*, *P. spinicornis* and *P. tulbaghensis* are all characterized by modifications of the peduncle of antenna 2 in the male, whereas in *P. barnardi* the male antenna 2 does not differ from the condition found in the female. The bizarre subchelate condition of the male pereopod 3, nearly transversely palm of gnathopod 2 and narrow basal article of pereopod 7 also distinguish *P. auricularis* from *P. barnardi*. Pereopods 5-7 of *P. crassicornis* are shorter, stouter and less setose than those of the new species which can also

be distinguished by the oblique palmar margins of the gnathopods. The forms of both pairs of gnathopods are also additional characters separating *P. seticornis* from *P. barnardi*. The relatively slender propods of gnathopods 1 and 2 and the deep coxa 4 are features which separate *P. spinicornis* and the present species. Additional characters distinguishing *P. tulbaghensis* from *P. barnardi* are the strongly produced eye lobe, elongate first peduncle article of antenna 1, short convex palm of gnathopod 2 and narrow basal articles of pereopods 6 and 7 of the former species. *P. granulicornis* has a strongly convex palm on gnathopod 2, unexcavate coxa 4, and a distally expanded merus on pereopods 3 and 4. In the key to *Paramelita* species given by Barnard (1927: 167) the species described herein keys down to the couplet separating *P. kogelensis* and *P. aurantius*, and it is to these two species that *P. barnardi* appears most closely related. Both of these species are smaller than *P. barnardi*. *P. kogelensis* can be separated from *P. barnardi* by the rather strongly setose flagellum of antenna 1, the shorter palm of gnathopod 2, the form of coxa 4, and the presence of a small blunt tooth at the posterior-distal angle of epimeron 3. *P. aurantius* is distinguished from *P. barnardi* by the relatively greater disparity in size between gnathopods 1 and 2, the more nearly transverse palms of these appendages and the deeper coxa 4.

Schellenberg (1926) and Barnard (1927) have noted the presence of sternal processes in species of *Paramelita*. Schellenberg (1930) has reviewed the presence of such structures in this and other genera, and shown that they are probably respiratory in function. Both specimens of *P. barnardi* possess sternal processes. In each case a single medial process occurs on the second and third pereon segments, pairs on segments 4, 5 and 7, and two pairs on segment 6. Histological sections of coxal gills and sternal processes from the present material show that the two types of appendage are basically similar in structure. The most obvious differences are the smaller and less regular longitudinal lumina of the sternal appendages. Coxal gills also show well-developed transverse lumina, which are absent from the sternal structures. Despite these differences, a respiratory function for the sternal processes seems probable, as was suggested by Schellenberg.

The ecological significance of sternal gills is not clear. Amphipod species bearing sternal gills are known from many fresh-water habitats in South America, South Africa, Australia, Japan, Alaska, Scandinavia and northern Russia. Many of these species belong to the family Gammaridae, but those from Japan are eusirids of the genus *Paramoera*, while most of the South American representatives belong to *Hyaella* (Hyaellidae). Sternal gills occur in most of the *Hyaella* species found in Lake Titicaca (Dr R. J. Lincoln, personal communication). In some cases the incidence of sternal gills can be correlated with adverse ecological conditions during part of the year (e.g. Barnard 1927), but it seems unlikely that this is the case with the whole of the *Hyaella*-complex in Lake Titicaca where speciation has allowed the occupation of a wide variety of niches.

The discovery of *P. barnardi* in the dark zone of a cave, the unpigmented eyes of all species except *P. nigroculus* and the ecological data given by Barnard (1927) suggest that some members of the genus are partially troglotic or phreatic in habit. The elongate appendages and loss of ocular elements in *Niphargus* suggest that *Paramelita* has not yet attained the obligatory subterranean status of the palaearctic genus.

SUMMARY

A new species of *Paramelita* is described from material collected in the hypogean zone of a cave on the Cape Peninsula. Evidence is presented favouring the theory of a respiratory function for the sternal processes found in this genus.

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